



AT A GLANCE

Office of Genomics and Disease Prevention

Seeking New Ways to Improve Public Health 2006



"Genomics is to the 21st century what infectious disease was to the 20th century . . . [it] should be considered in every facet of public health: infectious disease, chronic disease, occupational health, environmental health, [and] maternal and child health."

Gerard S, Hayes M, Rothstein MA. On the Edge of Tomorrow: Fitting Genomics into Public Health Policy. Journal of Law, Medicine, and Ethics 2002 Fall;30(3 Suppl):173–6.

The Importance of Genomics

What is Genomics?

Genetics is the study of inheritance, or the way traits are passed down from one generation to another. Genes carry the instructions for making proteins, which direct the activities of cells and functions of the body that influence traits such as hair and eye color. **Genomics** is a newer term that describes the study of all the genes in a person, as well as the interactions of those genes with each other and a person's environment.

All people are 99.9% identical in genetic makeup, but differences in the remaining 0.1% may hold important clues about the causes of disease. The study of genomics may help doctors and other health care professionals understand why some people get sick from certain infections, environmental factors, and behaviors, while others do not. This information could lead to new and better ways to improve health and prevent diseases.

CDC's Leadership

CDC is committed to ensuring that all people, especially those at greater risk for health disparities, will achieve their optimal lifespan with the best possible quality of health in every stage of life. With new health protection goals that support healthy people in healthy places across all life stages, CDC is setting the agenda to enable people to enjoy a healthy life by delaying death and the onset of illness and disability by accelerating improvements in public health.

CDC also recognizes the potential of genomic research to improve the public's health. In 1997, the agency responded to this potential by creating the **Office of Genomics and Disease Prevention (OGDP)**.

Since then, CDC has provided national public health leadership and built partnerships with other federal agencies, public health organizations, professional groups, and the private sector. In fiscal year 2006, Congress allocated nearly \$7 million for the OGDP.

CDC defines public health genomics as the study and application of knowledge about the human genome and interactions between genes and their environment as they relate to health and disease in populations.

Human Genome Research

The human genome is a person's complete set of DNA. In 2003, researchers completed the 13-year Human Genome Project, which identified all of the approximately 20,000–25,000 genes in human DNA. Much of this information is being transferred to the private sector to foster development of new medical applications. The project was coordinated by the U.S. Department of Energy and the National Institutes of Health (NIH), with support from international partners.

Now that the thousands of variations in human genes have been identified, researchers are studying these variations for associations with diseases of major public health importance, including chronic diseases such as heart disease, diabetes, stroke, and cancer, as well as infectious, environmental, and occupational diseases.

Activities in the area of public health genomics include the following:

- Conducting surveillance for diseases with known or suspected genetic components.
- Performing epidemiological studies to understand the interactions among genes, behaviors, and the environment as they relate to common diseases.
- Using the information collected through surveillance and research to develop evidence-based programs and policies.
- Educating health professionals and the general public about how genomics can be used to prevent disease and improve public health.
- Evaluating and ensuring access to genetic tests and services that can prevent disease and improve health for all Americans.



Genomics in Practice

Family History Public Health Initiative

People who have close relatives with common diseases such as heart disease, diabetes, and cancer are more likely to develop those diseases themselves. According to the 2004

HealthStyles Survey, 96% of Americans believe that knowing their family history is important to their health. Yet only about 33% say they have ever tried to gather and organize this information. Family health history is a low-cost, low-tech genomic tool that can provide vital clues about people's shared environment and behaviors, as well as their risk for developing a particular disease or condition.

In 2002, CDC, in collaboration with NIH, academia, and health care organizations, began an initiative to develop and evaluate whether family history can be used to assess risk for common diseases and strengthen early disease detection and prevention strategies.

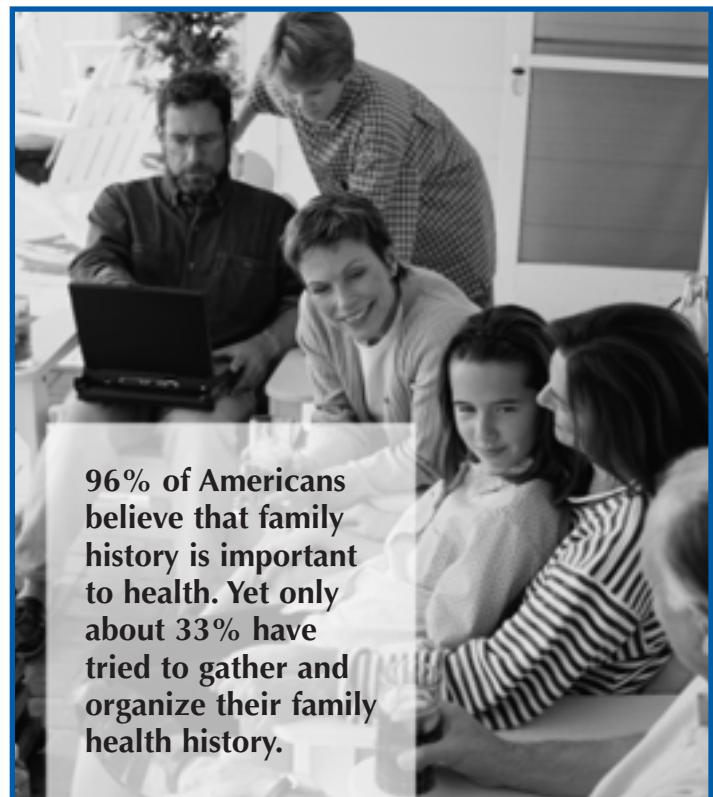
Major activities in 2005 included the following:

- Developed a Web-based tool called Family Healthware™ that collects information about health behaviors, screening tests, and a person's family history for stroke, coronary heart disease, diabetes, and colorectal, breast, and ovarian cancers. This tool is being evaluated for clinical use by three academic medical centers.
- Collaborated with the U.S. Department of Health and Human Services (HHS) on the Surgeon General's Family History Initiative, a campaign that marked Thanksgiving as National Family History Day. This project included creation of a Web-based tool called My Family Health Portrait (a simplified version of Family Healthware™) that organizes family health information into a printed version that people can take to their health care professional to help determine whether they are at higher risk for disease. In 2005, the tool was downloaded more than 360,000 times, and the printed version was distributed to more than 85,000 people nationwide.
- Promoted the importance of knowing your family history to the public by developing a Web site that includes fact sheets, case studies, news articles, and other resources (<http://www.cdc.gov/genomics/public/famhisMain.htm>).

EGAPP Project

The success of the Human Genome Project has led to rapid translation of genomic information into clinical applications. Although most of the more than 850 genetic tests available for clinical testing are used to diagnose single-gene disorders, a growing number have population-based applications.

In 2004, CDC launched a 3-year model project called Evaluation of Genomic Applications in Practice and Prevention (EGAPP) to support this process. The EGAPP Project is working to develop and evaluate a coordinated, systematic way to translate genomic research into clinical and public health practice. An independent, nonfederal, multi-disciplinary EGAPP Working Group was set up in 2005 to select genomic applications to evaluate, establish a review process, and develop recommendations.



Population Research

Integrating Genomics into Public Health Investigations

Public health investigations are essential to CDC's mission to improve public health. By collecting human genomic data, these investigations could help identify additional risk factors for disease susceptibility, severity, and transmission.

To create a foundation for genomic surveillance, CDC is

- Assessing and developing public health infrastructure and capacity to study genomics.
- Building a science base for genomics and its relationship to human exposure to diseases and environmental factors.
- Developing standard language for informed consent for DNA sample collection, storage, and testing.
- Developing standard guidelines and tools for specimen collection, processing, transport, and storage.

Genes of Public Health Importance

In 2004, CDC and NIH's National Cancer Institute began a collaboration to measure population variations in selected genes using stored DNA samples collected during the third National Health and Nutrition Examination Survey (NHANES). The goal of the project is to develop genotype prevalence estimates for a nationally representative sample of the U.S. population.

Genomics and Population Health

To translate genetic research into opportunities for preventive medicine and public health, CDC established the Human Genome Epidemiology Network (HuGENet™), a collaboration of about 700 individuals and organizations committed to developing and disseminating population-based human genome information. HuGENet™ products and services include a searchable online database of scientific literature in human genome epidemiology, fact sheets, an e-journal club, case studies that can be used for training, and information about HuGENet™ workshops.

Integrating Genomics into State Chronic Disease Programs

Centers for Genomics and Public Health

CDC funds Centers for Genomics and Public Health at Schools of Public Health at the University of Michigan and the University of Washington. These centers serve as regional hubs of expertise in genomics and public health with a focus on translating genomic information into practical public health knowledge, providing technical assistance to state and local public health agencies, and integrating genomics into programs and practice.

For example, the centers collaborated with CDC to provide two Web-based training programs for public health professionals. The first is a 45-minute introductory presentation called Genomics for Public Health Practitioners. It describes the application of genomics to public health, dispels myths, and identifies challenges in public health genomics. The second is a more in-depth program called Six Weeks to Genomics Awareness, which includes six presentations designed to help public health professionals understand how genomic advances are relevant to public health.

In 2005, CDC funded the centers in Washington and Michigan to continue their work and to develop new collaborations with OGDP on key projects, such as the Family History Public Health Initiative and the EGAPP Project.

State Capacity Grants

In July 2003, CDC established cooperative agreements with state health departments in Michigan, Minnesota, Oregon, and Utah to help them integrate genomic tools and knowledge into existing chronic disease programs. Since then, these states have

State Programs in Action

With support from CDC, states are working to educate their public health employees about how genomics can be used in the fight against chronic diseases. For example, **Utah** developed Genomics 101 presentations for public health professionals to increase their knowledge and interest in the topic. **Michigan** presented a workshop series called Cancer Genomics for Public Health to public health professionals working in the area of cancer control. **Minnesota** included genomics as a topic for regional chronic disease workshops held across the state, and it held the state's first Genomics and Public Health Conference in 2004.

In addition, states are looking for ways to incorporate genomics into existing chronic disease programs and activities. For example, **Minnesota** and **Oregon** have integrated genomics into their state comprehensive cancer control plans. **Michigan** and **Minnesota** are working with local WISEWOMAN (Well-Integrated Screening and Evaluation for Women Across the Nation) projects to evaluate and modify existing family history questions to identify women at increased risk for cardiovascular disease.

created new partnerships, educated their public health employees about genomics, integrated genomics into population-based surveillance, and used family history as a screening tool to identify populations at high risk and to more effectively target prevention messages. Highlights of these programs can be found in the April 2005 edition of CDC's online journal, *Preventing Chronic Diseases* (available at <http://www.cdc.gov/pcd/issues/2005/apr/toc.htm>).

Future Directions

CDC and its partners will continue to translate genomic advances into public health practice and will integrate genomics into research, policy, and programs. CDC also is working to create an infrastructure that will build on the achievements of the Human Genome Project to prevent disease and improve health in the 21st century.

For more information or additional copies of this document, please contact

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